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Report 3a: 2021 Storage and Spill Series Comparison with 2018

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Preface

A large proportion of New Zealand's electricity needs are met by generation from hydro power. Information about the distribution of inflows and the capability of the various hydro systems is necessary to ensure a reliable, competitive and efficient market and electricity system.

The hydrological modelling dataset (HMD) is a dataset of hydrological information made available by the Electricity Authority. The dataset was known as the SPECTRA update until 2010. In 2015 the dataset was revised to become the HMD, a comprehensive dataset that can be relied upon by modellers and analysts to test scenarios, provide commentary and inform decisions.

The HMD is comprised of data provided by hydro generators and supplemented with some from other sources. These parties are acknowledged for their contribution and for making this data available.

The HMD consists of three main components:

1. Infrastructure and hydrological constraint attributes:

This dataset records standing information about the capability of the main hydro schemes.

2. Flows:

This time series dataset records data for inflows for reservoirs and flows at various existing or potential hydro generating sites.

3. Storage and spill:

This time series dataset records storage for the main hydro schemes.

This report describes the differences between the 2018 HMD storage and spill series data and the 2021 HMD storage and spill series data.

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1 Introduction

Care is taken to ensure consistency of data between successive HMD updates. A comparison of the storage and spill flows for each series was undertaken and any changes are discussed further in Sections 2, 3 and 4.

2 Data Differences for Calculated Flow Sites

Differences between datasets may occur from one update to the next because of rating changes; data modifications; and various other reasons. Table 2-1 shows if there were any differences in the data between the previous and current update for the storage sites; Table 2-2 shows if there were any differences in the data between the previous and current update for the storage sites. The following sections highlight the reasons for these differences.

2.1 Averaging Differences

This update, data differences may arise due to changes in how the data is processed.

Historically, the raw data was averaged twice; for example, the raw lake level data was averaged to 3-hourly lake level following which, this data was averaged again to a daily lake level. This daily lake level was then used to calculate lake storage. There is no increased accuracy in averaging the data twice, therefore the data is now averaged once. This has resulted in very minor differences.

This does not significantly impact the derived lake storage or spill values.

Table 2-1: Data differences for previous and current updates for storage sites.

Storage site name	Data differs
Lake Taupo	YES
Lake Waikaremoana	YES
Lake Ohau	YES
Lake Tekapo	YES
Lake Pukaki	YES
Lake Wanaka	YES
Lake Hawea	YES
Lake Wakatipu	YES
Lake Te Anau	YES
Lake Manapouri	YES

Table 2-2: Data differences for previous and current updates for spill sites.

Lake	Spill site name	Data differs?
Lake Waikaremoana	Onepoto	YES
	Waikareteheke River at Piripaua	YES
	Waikareteheke River at Upstream Mangaone	YES
Lake Tekapo	Lake Tekapo at Gate 17	YES
	Lake George Scott to Tekapo River	NO
Lake Pukaki	Lake Pukaki	NO
Lake Ruataniwha	Lake Ruataniwha	NO
Lake Ohau	Lake Ohau	NO
Lake Benmore	Lake Benmore	NO
Lake Aviemore	Lake Aviemore	NO
Lake Waitaki	Lake Waitaki	YES
Lake Te Anau	Lake Te Anau	YES
Lake Manapouri	Lake Manapouri	YES
Lake Hawea	Lake Hawea	YES
Lake Dunstan	Clyde Dam	NO
Lake Roxburgh	Lake Roxburgh	NO
Lake Taupo	Lake Taupo	NO
Lake Aratiatia	Lake Aratiatia	NO
Lake Ohakuri	Lake Ohakuri	NO
Lake Atiamuri	Lake Atiamuri	NO
Lake Whakamaru	Lake Whakamaru	NO
Lake Maraetai	Lake Maraetai	NO
Lake Waipapa	Lake Waipapa	NO
Lake Arapuni	Lake Arapuni	NO
Lake Karapiro	Lake Karapiro	NO

3 Storage Sites

3.1 Lake Taupo

There are minor differences, of approximately $\pm 0.1\text{Mm}^3$, to the active storage from the 26-Jan-2014 to 31-Dec-2020. This is because of the way the raw input data has been averaged in the past updates compared to the current update. See Section 2.1 for more detail.

3.2 Lake Waikaremoana

There are minor differences to the active storage across the whole Lake Waikaremoana record. This is because of the way the raw input data has been averaged in the past updates compared to the current update. See Section 2.1 for more detail.

The raw data, provided by Genesis, was identical to the previous update. Therefore, the minor differences (typically, no more than ± 1 or 2%) in active storage at Lake Waikaremoana can be attributed to the change in methodology.

3.3 Lake Ohau

There are minor differences to the active storage across the whole Lake Ohau record. This is because of the way the raw input data has been averaged in the past updates compared to the current update. See Section 2.1 for more detail.

Furthermore, new lake level data, for the period of 3-Jun-2017 to 3-Jul-2017, was provided.

This resulted in minor differences to the datasets between the 2018 and 2021 outputs for storage volume for Lake Ohau of approximately $\pm 1\text{Mm}^3$.

3.4 Lake Tekapo

There are minor differences to the active storage across the whole Lake Tekapo record. This is because of the way the raw input data has been averaged in the past updates compared to the current update. See Section 2.1 for more detail.

Furthermore, new lake level data, for the period from 1-Jan-2015 to 3-May-2017, was provided. This amplifies the differences in active storage at Lake Tekapo between updates.

This resulted in minor differences to the datasets between the 2018 and 2021 outputs for storage volume for Lake Tekapo of approximately $\pm 1\text{Mm}^3$.

3.5 Lake Pukaki

There are very minor differences to the active storage across the whole Lake Pukaki record. This is because of the way the raw input data has been averaged in the past updates compared to the current update. See Section 2.1 for more detail.

Furthermore, new lake level data, for the period 20-Apr-2017 to 1-Jul-2017, was provided. This amplifies the differences in active storage at Lake Pukaki between updates.

This resulted in minor differences to the datasets between the 2018 and 2021 outputs for storage volume for Lake Pukaki of approximately $\pm 0.1\text{Mm}^3$.

3.6 Lake Manapouri

There are very minor differences to the active storage across the whole Lake Manapouri record. This is because of the way the raw input data has been averaged in the past updates compared to the current update. See Section 2.1 for more detail.

Furthermore, new lake level data, for the period 16-May-2010 to 1-Jan-2016 and 16-Jun-2016 to 1-Jan-2018, was provided. This amplifies the differences in active storage at Lake Manapouri between updates.

This resulted in very minor differences to the datasets between the 2018 and 2021 outputs for storage volume for Lake Manapouri of approximately $\pm 0.3\text{Mm}^3$.

3.7 Lake Wanaka

There are minor differences to the active storage across the whole Lake Wanaka record. This is because of the way the raw input data has been averaged in the past updates compared to the current update. See Section 2.1 for more detail.

This resulted in minor differences to the datasets between the 2018 and 2021 outputs for storage volume for Lake Wanaka of approximately $\pm 0.1\text{Mm}^3$.

3.8 Lake Hawea

There are minor differences to the active storage across the whole Lake Hawea record. This is because of the way the raw input data has been averaged in the past updates compared to the current update. See Section 2.1 for more detail.

Furthermore, differences can be attributed to changes in the historic RL at the site.

This resulted in minor differences to the datasets between the 2018 and 2021 outputs for storage volume for Lake Hawea of approximately $\pm 1\text{Mm}^3$.

3.9 Lake Wakatipu

There are minor differences to the active storage across the whole Lake Wakatipu record. This is because of the way the raw input data has been averaged in the past updates compared to the current update. See Section 2.1 for more detail.

Furthermore, differences can be attributed to changes in the historic RL at the site.

This resulted in minor differences to the datasets between the 2018 and 2021 outputs for storage volume for Lake Wakatipu of approximately $\pm 1\text{Mm}^3$.

3.10 Lake Te Anau

There are minor differences to the active storage across the whole Lake Te Anau record. This is because of the way the raw input data has been averaged in the past updates compared to the current update. See Section 2.1 for more detail.

This resulted in minor differences to the datasets between the 2018 and 2021 outputs for storage volume for Lake Te Anau of no more than $\pm 0.1\text{Mm}^3$.

4 Spill Sites

4.1 Lake Waikaremoana (Onepoto)

There are very minor differences of less than $\pm 0.1\text{ m}^3/\text{s}$ across the whole record (2-Nov-1998 to 31-Dec-2020) between updates.

These differences are due to changes in the data provided by Genesis. Historically, Genesis has provided raw spillway discharge data which closed in May 2018. For this update, Genesis provided raw flow data (i.e., spillway flow) from Onepoto Siphon 1 and 2. These two data sets were added together to represent the spillway discharge from Lake Waikaremoana. A comparison of the two

data sets (i.e., the raw lake Waikaremoana spillway discharge and the combined Onepoto Siphon spillway discharge) where they overlap show identical discharge patterns.

Therefore, the minor differences in the calculated spill volumes can be attributed to the way the raw input data has been averaged in the past updates compared to the current update. See Section 2.1 for more detail.

4.2 Waikareteheke River at Piripaua

There are minor differences to the spill data across the Waikaretaheke R. at Piripaua record. Genesis Energy provided different data this update because of changes to the ratings and water level associated with the site.

There are very minor differences in the dataset of less than $\pm 0.01\text{m}^3/\text{s}$, where the change in rating and/or water level has impacted the calculated spill flow. The key periods include:

- 6-Aug-2012 to 29-Oct-2012;
- 20-Jul-2015 to 28-Nov-2016; and
- 21-Aug-2018 to 16-Oct-2018.

4.3 Waikaretaheke River at Upstream Mangaone

There are very minor differences, of less than $\pm 0.1\text{m}^3/\text{s}$, to the spill data across the whole Waikaretaheke River at Upstream Mangaone record between updates. Genesis Energy provided different data this update, because of changes to the ratings associated with the site, for two periods; the 26-Dec-2016 to 10-Mar-2017 and 3-Oct-2017 to 11-Oct-2017.

Therefore, the differences in spill volume between updates relate to where the change in rating has impacted the calculated spill flow.

4.4 Lake Tekapo at Gate 17

There are minor differences to the spill data across the whole Lake Tekapo at Gate 17 record. These differences are no more than $\pm 0.2\text{m}^3/\text{s}$. Genesis Energy provided different data this update because of changes to the ratings associated with the site; these changes relate to the period from Nov-1999 to 31-Dec-2020.

Therefore, the differences in spill volume between updates relate to where the change in rating has impacted the calculated spill flow. Furthermore, differences have been amplified because of the way the raw input data has been averaged in the past updates compared to the current update. See Section 2.1 for more detail.

4.5 Lake Waitaki

There are minor differences, of approximately $\pm 2\text{m}^3/\text{s}$, to the spill data across the whole Lake Waitaki record. Meridian updated their spillway ratings in mid-2018, which included a recalculation of the spillway data backdated to 1965.

Therefore, the differences in spill volume between updates relate to where the change in spillway rating occurred, and subsequent back-calculation of data, has impacted the calculated spill flow.

4.6 Lake Te Anau

There are very minor differences, of approximately $\pm 0.22\text{m}^3/\text{s}$, to the spill data across the whole Lake Te Anau record. Lake Te Anau spill flow is based on the site Wairau River at Queens Reach.

NIWA provided a new rating for this site which resulted in the recalculation of spill back to the 23-May-2016.

Therefore, the differences in spill volume between updates relate to where the change in rating has impacted the calculated spill flow.

4.7 Lake Manapouri

There are very minor differences, of approximately +/- 0.1m³/s, to the spill data across the whole Lake Manapouri record. Meridian Energy provided different data this update because of changes to the ratings associated with the site.

Therefore, the differences in spill volume between updates relate to where the change in rating has impacted the calculated spill flow.

4.8 Lake Hawea

There are very minor differences, of approximately +/- 0.8m³/s, to the spill data across the whole Lake Hawea record. Contact Energy provided different data this update because of changes to the ratings associated with the site.

These rating changes required a recalculation of the entire outflow (i.e., spill) record. Therefore, the differences in spill volume between updates relate to where the change in ratings has impacted the calculated spill flow.

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